

LISTING OF CLAIMS

CLAIMS:

What is claimed is:

1. (Currently amended) A method for imparting a watermark onto a digitized image, said method comprising:

providing a digitized image having at least one image plane, said image plane being represented by an image array having a plurality of pixels, each pixel in said plurality of pixels ~~pixel~~ having at least one color component, said watermark being formed using a distinct watermarking plane represented by an array having a plurality of distinct watermarking elements, each of said distinct watermarking elements having an array position and having one-to-one positional correspondence with said image pixels, and

multiplying ~~said~~ brightness data associated with said at least one color component by a predetermined brightness multiplying factor, wherein said brightness multiplying factor is a corresponding distinct watermarking element, and said watermark has a invisibility classification.

2. (Original) A method as recited in claim 1, wherein said brightness multiplying factor has a relationship with a number taken from a random number sequence.

3. (Original) A method as recited in claim 2, wherein said relationship is a linear remapping to provide a desired modulation strength.

4. (Original) A method as recited in claim 3, wherein said modulation strength lies in the domain greater than or equal to zero and less than or equal to 0.5.

5. (Original) A method for imparting a watermark onto a digitized image comprising the steps of:

1 providing said digitized image comprised of a plurality of pixels, wherein each of said pixels
2 includes brightness data that represents a brightness of at least one color; and

3 altering said brightness data associated with a plurality of said pixels maintaining the hue and
4 saturation of said pixel.

5 6. (Original) A method as recited in claim 5, wherein said image has I rows and J columns, and
6 has a pixel in row i and column j having at least one brightness, $Y(i,j)$, and the step of altering
7 includes:

8 adding to or subtracting from the brightness $Y(i,j)$ a different small random value $e(i,j)$, wherein $1 \leq$
9 $i \leq I$ and $1 \leq j \leq J$ are the row and column indices of a pixel location in the image.

10 7. (Original) A method as recited in claim 6, wherein the step of adding to or subtracting from
1 includes making $e(i,j)$ proportional to an original brightness of the pixel.

2 8. (Original) A method as recited in claim 6, wherein color components of the unaltered pixel
3 are $X(i,j)$, $Y(i,j)$, and $Z(i,j)$, and color components of the brightness altered pixel are $X'(i,j)$, $Y'(i,j)$,
4 and $Z'(i,j)$, and the step of adding to or subtracting from includes setting $e(i,j) = d(i,j)Y(i,j)$, where
5 $d(i,j)$ is a value selected from an array of random values within a range of $0 \leq d(i,j) \leq 1$, such that
6 the modified brightness $Y'(i,j) = Y(i,j) + e(i,j) = Y(i,j) + d(i,j)Y(i,j)$, and $X'(i,j)/X(i,j) = Z'(i,j)/Z(i,j) =$
7 $Y'(i,j)/Y(i,j) = e(i,j) = 1 - d(i,j)$.

8 9. (Original) A method as recited in claim 8, wherein the step of setting includes preserving
9 ratios of color components in each pixel.

10 10. (Original) A method as recited in claim 9, wherein the step of preserving includes setting
1 $X'(i,j)/X(i,j) = Z'(i,j)/Z(i,j) = Y'(i,j)/Y(i,j) = 1 - d(i,j)$, wherein the color components of the unaltered
2 pixel are $X(i,j)$, $Y(i,j)$, and $Z(i,j)$, and the color components of the brightness altered pixel are $X'(i,j)$,
3 $Y'(i,j)$, and $Z'(i,j)$.

1 11. (canceled)

2 13. (Original) A method for generating a watermarked image, the method comprising:

3 imparting a watermark onto a digitized image having a plurality of original pixels, each of said pixels
4 having at least one original pixel brightness value;

5 providing said digitized watermarking plane comprising a plurality of watermarking
6 elements, each element having a watermark brightness multiplying factor and having one-to-one
7 positional correspondence with said original pixels; and

8 producing a watermarked image by multiplying said original brightness of each of said
9 original pixels by said brightness multiplying factor of a corresponding one of said watermark
0 elements.

1 14. (Original) A method comprising:

2 forming a watermarking plane including a plurality of elements each having a brightness adding or
3 subtracting factor, including the steps of:

4 generating a secure random sequence of integers having a first plurality of bits;

5 linearly remapping said random sequence to form a remapped sequence of brightness
6 multiplying factors to provide a desired modulation strength;

7 computing a discrete Fourier transform of said remapped sequence to form a Fourier
8 sequence having frequency coordinates;

9 expanding said frequency coordinates to form an expanded sequence;

0 computing an inverse discrete Fourier transform of said expanded sequence to obtain a

1 watermarking sequence of values; and

2 deriving said brightness adding or subtracting values of said elements of said watermarking
3 plane based upon said watermarking sequence of values.

4 15. (Currently Amended) A method for detecting a watermark in a marked image, said method
5 comprising:

6 providing said marked image marked by a watermarking plane, said marked image having at least
7 one color plane including a plurality of image pixels, said watermarking plane having a plurality of
8 watermarking elements, wherein each of said image pixels has at least one brightness value and each
9 of said watermarking elements has a brightness adding and/or subtracting factor, including the steps
10 of:

1 (a) reconstructing said watermarking plane;

2 (b) aligning said watermarking plane with said marked image such that each watermarking
3 element has a corresponding image pixel;

4 (c) providing a selector array and a visualizer image of equal size, wherein said selector array
5 has a plurality of selector elements each having at least one counter, and wherein said visualizer
6 image has a plurality of visualizer pixels each having at least one brightness value, and wherein said
7 visualizer pixels represent a recognizable pattern when displayed;

8 (d) resetting said at least one counter to zero;

9 (e) placing said selector in an initial position by aligning said selector elements with a
10 plurality of corresponding image pixels and a plurality of corresponding watermarking elements;

1 (f) choosing a selector element and identifying a corresponding watermarking element;

1 (g) identifying a first plurality of watermarking elements that neighbor said corresponding
2 watermarking element;

3 (h) generating a first average that represents an average of brightness—~~multiplying~~ adding
4 and/or subtracting factors of said first plurality of watermarking elements;

5 (i) choosing a color plane of said marked image and finding a corresponding image pixel;

6 (j) identifying a first plurality of neighboring pixels that neighbor said corresponding image
7 pixel;

8 (k) generating a second average that represents an average of brightness values of said first
9 plurality of neighboring pixels;

1 (l) updating said at least one counter based upon first and second comparison operations,
2 wherein said first comparison operation compares said first average with said brightness adding
3 and/or subtracting ~~multiplying~~ factor of said corresponding watermarking element and said second
4 comparison operation compares said second average with said brightness value of said corresponding
5 pixel;

6 (m) repeating steps (i) through (l) for all color planes;

7 (n) repeating steps (f) through (m) for all selector elements;

8 (o) choosing a new selector position that does not overlap any previous selector position;

9 (p) repeating steps (f) through (o) for all non-overlapping selector positions; and

1 (q) generating a visual representation indicating detection of said watermark in said marked
2 image utilizing said at least one counter of said selector array and said visualizer pixels.

- 1 16. (Original) A method for detecting a watermarking plane comprising the steps of:
- 2 providing an image having a plurality of image pixels, $u(i,j)$, with said image having I rows
- 3 and J columns, and a pixel in row i and column j having at least one component, marked by a
- 4 watermarking plane; said watermarking plane having a plurality of watermarking elements, $w(i,j)$,
- 5 with said watermarking plane having I rows and J columns, and an element in row i and column j
- 6 having a brightness multiplying factor;
- 7 aligning said watermarking plane with said image;
- 8 identifying a subset of said image elements;
- 9 for each pixel, $u(i,j)$, of said subset of image pixels,
- 0 generating a first value representing a relationship between an attribute of said pixel
- 1 $u(i,j)$ and an attribute of image pixels that neighbor said pixel $u(i,j)$;
- 2 1 identifying a watermarking element, $w(i,j)$, that corresponds to said pixel $u(i,j)$ and
- 3 watermarking elements that correspond to said image pixels that neighbor said image pixel $u(i,j)$;
- 4 generating a second value representing a relationship between an attribute of said
- 5 watermarking element $w(i,j)$ and an attribute of the identified watermarking elements; and
- 6 generating a coincidence value representing a likelihood that said image is marked by
- 7 said watermarking plane based upon said first and second values.

- 3 17. (Original) A method as recited in claim 1, wherein said distinct watermarking element, has a
- 9 value being in the domain greater than or equal to zero and less than or equal to one.

- 0 18. (Original) A method for imparting a watermark onto a digitized image comprising the steps of:

- 1 providing said digitized image comprised of a plurality of image pixels with said digitized

1 image having I rows and J columns, and a pixel in row i and column j having at least one component,
2 $Y(i,j)$; and

3 adding to or subtracting from said brightness data associated with at least one of said pixels a
4 predetermined brightness adding factor in the range of 0 to $Y(i,j)$, or brightness subtracting factor in
5 the range of 0 to $Y(i,j)$.

6 wherein said brightness adding or subtracting factor has a relationship with a number taken from a
7 random number sequence, said relationship is a linear remapping to provide a desired modulation
8 strength, and said modulation strength is less than or equal to 50 percent.

9 19. (Original) A method for imparting a watermark onto a digitized image comprising the steps of:

10 providing said digitized image comprised of a plurality of image pixels with said image
1 having I rows and J columns, and a pixel in row i and column j having at least one component,
2 $Y(i,j)$; and

3 adding to or subtracting from said brightness data associated with at least one of said pixels
4 by a predetermined brightness adding or subtracting factor in the range of 0 to $Y(i,j)$,

5 wherein said brightness adding or subtracting factor has a relationship with a number taken from a
6 random number sequence, said relationship is a linear remapping to provide a desired modulation
7 strength, said sequence is formed from a plurality of robust watermarking parameters, and said
8 parameters comprise a cryptographic key, two coefficients and an initial value of said random
9 number generator.

10 20. (Original) A method for detecting a watermark, said method comprising:

1 providing a marked image having a plurality of image pixels said marked image being marked by a
2 watermarking plane, having a plurality of watermark elements;

1 aligning said watermarking plane with said marked image, and
2 generating a coincidence value by averaging a detection coincidence for each selector element of a
3 group of selector elements taken from said image pixels.
4

5 21. (Original) A method as recited in claim 20, wherein each of said group of selector elements
6 has a selector size, said method further comprising:

7 providing a visualizer pattern having a plurality of visualizer pixels and a visualizer size equal to said
8 selector size, each of said visualizer pixels being associated with one of said selector elements and
9 having a visualizer color; and

10 displaying a watermark detection pattern having a size at least equal to said visualizer size and a
11 plurality of visualizer-coincidence pixels, wherein each of said visualizer-coincidence pixels is
12 associated with a corresponding selector element and a corresponding visualizer pixel, and each of
13 said visualizer-coincidence pixels being displayed having said visualizer color when said
14 coincidence value of said corresponding selected element has an indication of a detection success
15 and having another color otherwise.

16 22. (Original) A method as recited in claim 20 wherein said watermark is based on a factor
17 multiplying a brightness value of each of said image pixels.

18 23. (Original) A method as recited in claim 20, further comprising:

19 reconstructing said watermarking plane used in generating said watermark.
20

21 24. (Original) A method as recited in claim 23, wherein said watermarking plane has a plurality
22 of watermarking elements, said method further comprising:

23 rotating, resizing and said image to bring it to a size and position of an original image, and

1 aligning said watermarking plane with said marked image such that each of said watermarking
2 elements has a corresponding image pixel.

3 25. (Original) A method as recited in claim 20, wherein each said group contains 128 elements.

4 26. (Original) A method as recited in claim 20, wherein each pixel of said image pixels has a
5 monochrome brightness value.

5 27. (Original) A method as recited in claim 20, wherein said watermarking plane is generated
7 using a plurality of robust watermarking parameters.

3 28. (Currently amended) A method as recited in claim 20, wherein said coincidence ~~variable~~
9 value is determined using a statistically related attribute relating each said selector element to a
1 plurality of neighboring elements.

1 29. (Original) A method as recited in claim 28, wherein said attribute is a brightness value.
2

3 30. (Original) A method for detecting a watermark imparted on an image, said method
4 comprising:

5 providing said image having at least one image plane, said image plane being represented by an
5 image array having a plurality of image elements, said watermark being formed using a
7 watermarking plane represented by a watermarking array having a plurality of watermarking
3 elements, each of said watermarking elements having a first array position and having one-to-one
9 positional correspondence with said image elements;

1 computing a first statistically related variable for each element of at least one first grouping of a first
1 selector array of elements taken from said image elements, wherein each of said image elements has
2 a second array position;

3 computing a second statistically related variable for each element of at least one second grouping of

1 a second selector array of elements taken from said watermarking elements, wherein each element of
2 said second selector array of elements has one-to-one positional correspondence with said first
3 selector array, and wherein said correspondence forms combinations of corresponding elements;

4 comparing to determine an affirmative and non-affirmative likeness of said first and second
5 statistically related variables for each of said combinations of corresponding elements; and

6 forming at least one comparison array having one-to-one correspondence with said at least one first
7 grouping and having a plurality of comparison elements, wherein each of said comparison elements
8 contains a positive detection indication for each element of said first grouping when said step of
9 comparing results in an affirmative likeness, and a negative detection indication for each element of
0 said first grouping when said step of comparing results in a non-affirmative likeness.

1 31. (Original) A method as recited in claim 30, wherein said watermark is formed by adding or
2 subtracting a brightness factor of each of said image elements by an amount contained in a
3 corresponding element of said watermarking elements.

4 32. (Original) A method as recited in claim 30, wherein said first grouping corresponds to a
5 selector positioned to encompass said first selector array of elements forming a rectangular cluster of
6 elements.

7 33. (Original) A method as recited in claim 30, wherein said first statistical variable is formed by
8 comparing an attribute of said each element of said first selector array of elements to an average
9 attribute of its 128 closest neighbors.

0 34. (Currently amended) A method as recited in claim 33 ~~30~~, wherein said attribute is a ratio of
1 the color component to the average of neighboring color components in the same color plane.

2 35. (Original) A method as recited in claim 30, wherein each of said at least one first grouping is
3 positioned so as not to overlap any other of said at least one first grouping.
4

1 36. (Original) A method as recited in claim 30, wherein each said comparison elements has a
2 particular position in said comparison array, said method further comprising:

3 determining an average percentage of said affirmative and non-affirmative likeness of each element
4 of said comparison elements having a same particular position in all arrays of said at least one
5 comparison array, and

6 forming a detection array of elements having one-to-one element correspondence with said
7 comparison elements, wherein each element of said detection array of elements contains said average
8 percentage.

9 37. (Original) A method as recited in claim 36, further comprising the steps of:

10 providing a visualizer pattern of pixels represented by an array having visualizer pixels which have
1 one-to-one element correspondence with said detection array, each of said visualizer pixels has a first
2 logical value if a corresponding visualizer pixel is black, and a complementary logical value if said
3 corresponding pixel is white;

4 forming a visualizer coincidence image having a plurality of coincidence pixels, wherein a
5 coincidence pixel has a corresponding visualizer pixel and a corresponding detection array element;
6 and

7 setting said coincidence pixel to black if both said corresponding visualizer pixel is black and said
8 percentage average of said corresponding detection array element has a value greater than a
9 predetermined detection threshold, otherwise setting said coincidence pixel to white.

10 38. (Original) A method as recited in claim 30, wherein said image has three color planes.

1 39. (Original) A method comprising generating a visual representation of a data array of data
2 elements having a data array size, including the steps of:

1 providing a visualizer pattern of visualizer pixels represented by a visualizer array of
2 visualizer pixels, said visualizer array having a visualizer array size equal to said data array size;

3 forming a visualizer-coincidence image of image pixels represented by an image array having
4 an image array size equal to said visualizer array size;

5 setting each said visualizer-coincidence pixel to the color of said corresponding visualizer
6 pixel if a value of said corresponding data element is above a predetermined threshold and to another
7 color if said value is below said predetermined threshold; and

8 displaying said visualizer-coincidence image to form said visual representation.

9 40. (Original) A method as recited in claim 39, wherein said data array represents data resulting from
10 a watermark detection implementation.

1 41. (Original) A method as recited in claim 39, wherein said first color is black and said second color
2 is white.

3 42. (Original) A method as recited in claim 39, wherein said threshold is set at a fifty percent success
4 rate.

5 43. (Original) A method for demonstrating an existence of a watermark in a marked image, said
6 image having a plurality of image pixels, said method comprising:

7 providing a visualizer pattern represented by an array of visualizer elements, each of said visualizer
8 elements corresponding with one pixel of a plurality of visualizer pixels and having a first value if
9 said one pixel has a first color and a second value if said one pixel has a second color, said visualizer
10 array having a visualizer array size;

1 implementing a watermark detection scheme and computing a coincidence value for each of said
2 image pixels within a plurality of pixel selector arrays taken from among said image pixels, each of

1 said pixel selector arrays having a selector array size equal to said visualizer array size;
2
3 forming a detection array from a plurality of coincidence values, wherein said detection array has a
4 detection array size equal to said visualizer size; and

5 computing a coincidence detection value for each of said visualizer elements such that said detection
6 value represents a visualizer.

7 44. (Original) A method for detecting a watermark in a marked image having a plurality of image
8 pixels, said marked image marked by a watermarking plane having a plurality of watermarking
9 elements, said method comprising:

10 providing a visualizer pattern having a plurality of visualizer pixels and a visualizer size;

11 aligning said watermarking plane with said marked image such that each said image pixel has a
12 corresponding watermarking element;

13 generating a statistically related variable for each image element in a plurality of groupings of image
14 elements in relationship with said corresponding watermarking element; wherein each of said
15 groupings has a grouping size equal to said visualizer size;

16 averaging said variable for each element in a like position of all of said groupings to obtain a
17 composite detection success value; and

18 displaying detection success values by a plurality of visualizer-coincidence pixels having a size equal
19 to said visualizer size, each said visualizer-coincidence pixel having a same color as said
20 corresponding visualizer pixel when said corresponding success value indicates detection success
21 and another color otherwise.

22 45. (Currently amended) A computer program product comprising a computer usable medium having
23 computer readable program code means embodied therein for causing a watermark to be imparted

1 into an image, the computer readable program code means in said computer program product
2 comprising computer readable program code means for causing a computer to effect the steps of
3 ~~claim 1:~~

4 providing a digitized image having at least one image plane, said image plane being
5 represented by an image array having a plurality of pixels, each pixel in said plurality of pixels ~~pixel~~
6 having at least one color component, said watermark being formed using a distinct watermarking
7 plane represented by an array having a plurality of distinct watermarking elements, each of said
8 distinct watermarking elements having an array position and having one-to-one positional
9 correspondence with said image pixels, and

10 multiplying ~~said~~ brightness data associated with said at least one color component by a
1 predetermined brightness multiplying factor, wherein said brightness multiplying factor is a
2 corresponding distinct watermarking element, and said watermark has a invisibility classification.

3 46. (Currently amended) A computer program product comprising a computer usable medium having
4 computer readable program code means embodied therein for causing a watermark to be imparted
5 into an image, the computer readable program code means in said computer program product
6 comprising computer readable program code means for causing a computer to effect the steps of
7 claim 5:

8 providing said digitized image comprised of a plurality of pixels, wherein each of said pixels
9 includes brightness data that represents a brightness of at least one color; and

10 altering said brightness data associated with a plurality of said pixels maintaining the hue and
11 saturation of said pixel.

12 47. (Canceled)

13 48. (Currently amended) A computer program product comprising a computer usable medium having
14 computer readable program code means embodied therein for causing generation of a watermarked
15 image, the computer readable program code means in said computer program product comprising

- 1 computer readable program code means for causing a computer to effect the steps of claim 13;
- 2 imparting a watermark onto a digitized image having a plurality of original pixels, each of said pixels
3 having at least one original pixel brightness value;
- 4 providing said digitized watermarking plane comprising a plurality of watermarking
5 elements, each element having a watermark brightness multiplying factor and having one-to-one
6 positional correspondence with said original pixels; and
- 7 producing a watermarked image by multiplying said original brightness of each of said
8 original pixels by said brightness multiplying factor of a corresponding one of said watermark
9 elements.
- 10 49. (Currently amended) A computer program product comprising a computer usable medium having
- 1 computer readable program code means embodied therein for causing formation of a watermarking
- 2 plane, the computer readable program code means in said computer program product comprising
- 3 computer readable program code means for causing a computer to effect the steps of claim 14:
- 4 forming a watermarking plane including a plurality of elements each having a brightness adding or
5 subtracting factor, including the steps of:
- 6 generating a secure random sequence of integers having a first plurality of bits;
- 7 linearly remapping said random sequence to form a remapped sequence of brightness
8 multiplying factors to provide a desired modulation strength;
- 9 computing a discrete Fourier transform of said remapped sequence to form a Fourier
10 sequence having frequency coordinates;
- 1 expanding said frequency coordinates to form an expanded sequence;

1 computing an inverse discrete Fourier transform of said expanded sequence to obtain a
2 watermarking sequence of values; and

3 deriving said brightness adding or subtracting values of said elements of said watermarking
4 plane based upon said watermarking sequence of values.

5 50. (Currently amended) An article of manufacture comprising a computer usable medium having
6 computer readable program code means embodied therein for causing detection of a watermark in a
7 marked image, the computer readable program code means in said article of manufacture comprising
8 computer readable program code means for causing a computer to effect the steps of claim 15:

9 providing said marked image marked by a watermarking plane, said marked image having at least
10 one color plane including a plurality of image pixels, said watermarking plane having a plurality of
11 watermarking elements, wherein each of said image pixels has at least one brightness value and each
12 of said watermarking elements has a brightness adding and/or subtracting factor, including the steps
13 of:

14 (a) reconstructing said watermarking plane;

15 (b) aligning said watermarking plane with said marked image such that each watermarking
16 element has a corresponding image pixel;

17 (c) providing a selector array and a visualizer image of equal size, wherein said selector array
18 has a plurality of selector elements each having at least one counter, and wherein said visualizer
19 image has a plurality of visualizer pixels each having at least one brightness value, and wherein said
20 visualizer pixels represent a recognizable pattern when displayed;

21 (d) resetting said at least one counter to zero;

22 (e) placing said selector in an initial position by aligning said selector elements with a
23 plurality of corresponding image pixels and a plurality of corresponding watermarking elements;

- 1 (f) choosing a selector element and identifying a corresponding watermarking element;
- 2 (g) identifying a first plurality of watermarking elements that neighbor said corresponding
- 3 watermarking element;
- 4 (h) generating a first average that represents an average of brightness multiplying factors of
- 5 said first plurality of watermarking elements;
- 6 (i) choosing a color plane of said marked image and finding a corresponding image pixel;
- 7 (j) identifying a first plurality of neighboring pixels that neighbor said corresponding image
- 8 pixel;
- 9 -
- 10 (k) generating a second average that represents an average of brightness values of said first
- 11 plurality of neighboring pixels;
- 12 (l) updating said at least one counter based upon first and second comparison operations,
- 13 wherein said first comparison operation compares said first average with said brightness multiplying
- 14 factor of said corresponding watermarking element and said second comparison operation compares
- 15 said second average with said brightness value of said corresponding pixel;
- 16 (m) repeating steps (i) through (l) for all color planes;
- 17 (n) repeating steps (f) through (m) for all selector elements;
- 18 (o) choosing a new selector position that does not overlap any previous selector position;
- 19 (p) repeating steps (f) through (o) for all non-overlapping selector positions; and
- 20 (q) generating a visual representation indicating detection of said watermark in said marked

1 image utilizing said at least one counter of said selector array and said visualizer pixels.

2 51. (Original) An article of manufacture comprising a computer usable medium having computer
3 readable program code means embodied therein for causing detection of a watermark in a marked
4 image, the computer readable program code means in said article of manufacture comprising
5 computer readable program code means for causing a computer to effect the steps of claim 16.

5 52. (Original) An article of manufacture comprising a computer usable medium having computer
7 readable program code means embodied therein for causing generation of a visual representation of a
3 data array of data elements, the computer readable program code means in said article of
9 manufacture comprising computer readable program code means for causing a computer to effect the
1 steps of claim 39.

1 53. (Original) An article of manufacture comprising a computer usable medium having computer
2 readable program code means embodied therein for causing a watermark to be imparted onto a
3 digitized image, the computer readable program code means in said article of manufacture
4 comprising computer readable program code means for causing a computer to effect the steps of
5 claim 18.

5 54. (Original) An article of manufacture comprising a computer usable medium having computer
7 readable program code means embodied therein for causing a watermark to be imparted onto a
3 digitized image, the computer readable program code means in said article of manufacture
9 comprising computer readable program code means for causing a computer to effect the steps of
1 claim 19.

1 55. (Original) An article of manufacture comprising a computer usable medium having computer
2 readable program code means embodied therein for causing detection of a watermark imparted onto
3 a digitized image, the computer readable program code means in said article of manufacture
4 comprising computer readable program code means for causing a computer to effect the steps of
5 claim 20.

1 56. (Original) An article of manufacture comprising a computer usable medium having computer
2 readable program code means embodied therein for causing detection of a watermark in a marked
3 image, the computer readable program code means in said article of manufacture comprising
4 computer readable program code means for causing a computer to effect the steps of claim 30.

5 57. (Currently amended and Withdrawn) An article of manufacture comprising a computer usable
6 medium having computer readable program code means embodied therein for causing generation of
7 a visual representation of a data array of data elements, the computer readable program code means
8 in said article of manufacture comprising computer readable program code means for causing a
9 computer to effect the steps of claim 39 40.

10 58. (Original) An article of manufacture comprising a computer usable medium having computer
11 readable program code means embodied therein for causing demonstration of an existence of a
12 watermark in a marked image, the computer readable program code means in said article of
13 manufacture comprising computer readable program code means for causing a computer to effect the
14 steps of claim 43.

15 59. (Original) A computer program product comprising a computer usable medium having computer
16 readable program code means embodied therein for causing detection of a watermark in a marked
17 image, the computer readable program code means in said computer program product comprising
18 computer readable program code means for causing a computer to effect the steps of claim 44.

19 60. (Original) An apparatus to impart a watermark onto a digitized image, said apparatus
20 comprising mechanisms for implementing the method of claim 1.

21 61. (Original) An apparatus for imparting a watermark onto a digitized image comprising
22 mechanisms for implementing the method of claim 5.

23 62. (Original) An apparatus for imparting a watermark onto a digitized image comprising
24 mechanisms for implementing the method of claim 6.

1 63. (Canceled)

2 64. (Original) A method for detecting a watermark in a marked image, said method comprising:

3 providing said marked image having said watermark;

4 altering said marked image employing a blurring filter in producing a filtered image; and

5 employing a watermark detection method upon said filtered image to detect said watermark.

5 65. (Original) A method for detecting a watermark in a marked image, said method comprising:

7 providing said marked image having said watermark;

3 processing the marked image and producing a screened image;

9 altering said screened image employing a blurring filter in producing a filtered image; and

1 employing a watermark detection method upon said filtered image to detect said watermark.

1 66. (Original) A method as recited in claim 65, wherein the step of processing includes producing a

2 derivative image by screening, printing and scanning the marked image.

3 67. (Original) A method as recited in claim 15, wherein the step of aligning includes altering said

4 marked image employing a blurring filter.

5 68. (Currently amended) A method as recited in claim 16, wherein the image is a marked image, and

5 the step of aligning includes altering said marked image employing a blurring filter.

7 69. (Currently amended) A method as recited in claim 20, wherein the image is a marked image, and

3 the step of aligning includes altering said marked image employing a blurring filter.

1 70. (Currently amended) A method as recited in claim 30, wherein the image is a marked image, and
2 the step of providing includes altering said marked image employing a blurring filter.

3 71. (Currently amended) A method as recited in claim 44, wherein the image is a marked image, and
4 the step of aligning includes altering said marked image employing a blurring filter.

5 72. (Currently amended) An article of manufacture as recited in claim 51, wherein the image is a
6 marked image, and the step of aligning includes altering said marked image employing a blurring
7 filter.

3 73. (Currently amended) An article of manufacture as recited in claim 59, wherein the image is a
9 marked image, and the step of aligning includes altering said marked image employing a blurring
1 filter.

1 74. (Currently amended) An apparatus as recited in claim 61, wherein the image is a marked image,
2 and the means of providing mechanisms for implementing includes means for altering said marked
3 image employing a blurring filter.

4 75. (Original) A method of generating a visual representation of a data array of data elements having
5 a data array size, said method comprising:

5 providing a visualizer pattern of visualizer pixels represented by a visualizer array of visualizer
7 elements, said visualizer array having a visualizer array size equal to said data array size, wherein
3 each of said visualizer elements has a first logical value if a corresponding visualizer pixel is a first
9 color and a complementary logical value if said corresponding visualizer pixel has a second color;

1 forming a data image of image pixels represented by an image array having an image array size equal
1 to said data array size, wherein an image pixel has a corresponding data element and a corresponding
2 visualizer pixel;

1 setting said data pixel to a color of said corresponding visualizer pixel if a value of said data element
2 is above a predetermined threshold and to another color if said value is below said predetermined
3 threshold; and
4
5 displaying said data image to form said visual representation.

5 76. (Original) A method as recited in claim 75, wherein said data array represents data resulting from
7 a watermark detection implementation.

3 77. (Original) A method as recited in claim 75, wherein said first color is black and said second color
9 is white.

7 78. (Original) A method as recited in claim 75, wherein said threshold is set at a fifty percent success
1 rate.

2 79. (Original) An article of manufacture comprising a computer usable medium having computer
3 readable program code means embodied therein for causing generation of a visual representation of a
4 data array of data elements, the computer readable program code means in said article of
5 manufacture comprising computer readable program code means for causing a computer to effect the
5 steps of claim 75.

7 80. (Original) A computer program product comprising a computer usable medium having computer
3 readable program code means embodied therein for causing generation of a visual representation of a
9 data array of data elements, the computer readable program code means in said computer program
7 product comprising computer readable program code means for causing a computer to effect the
1 steps of claim 75.

2 81. (Original) An apparatus for generating a watermarked image comprising mechanisms for
3 implementing the method of claim 13.

4 82. (Original) An apparatus comprising mechanisms for implementing the method of claim 14.

1 83. (Original) An apparatus for detecting a watermark in a marked image comprising mechanisms
2 for implementing the method of claim 15.

3 84. (Original) An apparatus for detecting a watermarking plane comprising mechanisms for
4 implementing the method of claim 16.

5 85. (Original) An apparatus for imparting a watermark onto a digitized image comprising
5 mechanisms for implementing the method of claim 19.

7 86. (Original) An apparatus for detecting a watermark comprising mechanisms for implementing the
3 method of claim 20.

9 87. (Original) An apparatus for detecting a watermark comprising mechanisms for implementing the
9 method of claim 30.

1 88. (Original) An apparatus for demonstrating an existence of a watermark in a marked image
2 comprising mechanisms for implementing the method of claim 43.

3 89. (Original) An apparatus for detecting a watermark comprising mechanisms for implementing the
4 method of claim 44.

5 90. (Original) A method for detecting a watermarking plane comprising the steps of:

5 providing an image having a plurality of image pixels, $u(i,j)$, with said image having I rows
7 and J columns, and a pixel in row i and column j having at least one component, marked by a
3 watermarking plane; said watermarking plane having a plurality of watermarking elements, $w(i,j)$,
9 with said watermarking plane having I rows and J columns, and an element in row i and column j
9 having a brightness multiplying factor;

1 aligning said watermarking plane with said image;

- 1 identifying a subset of said image elements; and
- 2 for each pixel, $u(i,j)$, of said subset of image pixels, employing a detection scheme in
- 3 determining a probability of watermark detection based on a property of uniform distribution of the
- 4 random brightness multiplying factors or the random brightness adding or subtracting factors.